Monolithic Linear IC



No.3222A

LA5601

Low Dropout Regulator with Reset

Overview

The LA5601 is a voltage regulator with a low-voltage detector and reset controller for use in microprocessor-based systems. It generates a reset signal for low power supply voltage. It also features a low 0.25V (typ.) dropout voltage for reduced power dissipation and power supply size. Applications include microprocessor-controlled consumer electronic equipment such as CD players, tuners and receivers, and preamplifiers.

Functions

- Low dropout regulator with 250mA and 5.2V output
- Power supply reset generator function
- Supports on-off control of 5.2V using equipped enable pin (high active)
- Built-in Darlington driver (120mA)
- Built-in auxiliary regulator (5.2V, 250mA)

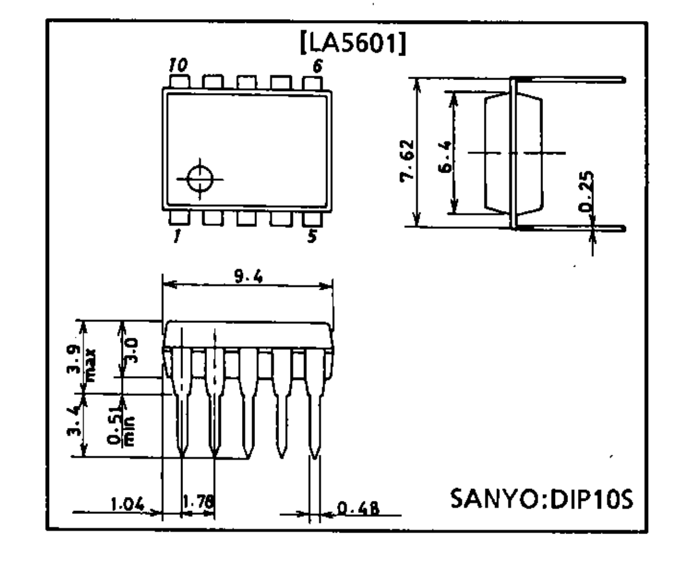
Features

- Low minimum input -output voltage difference (0.3V typ.)
- Supports setting of reset output delay time using external capacitor
- Built-in fold-back current limiting circuit and excessive heat protection circuit.
- Reset output using active pull-up for simpler noise reduction and use with internal pull-down logic circuits
- Error amplifier noise filter pin
- Auxiliary regulator with reverse current protection

Package Dimensions

unit:mm

3098-DIP10S



SANYO:DIP10S

Specifications

Maximum Ratings at Ta = 25°C

			unit
Input Voltage	V_{IN} max	15	V
Enable Pin Voltage	V_{EN} max	V_{IN} max	V
Reset Output Pin Voltage	$V_{\overline{RES}}$ max	15	V
Driver Output Voltage	V_{OD} max	15	V
Driver Input Voltage	V_{ID} max	15	V
Allowable Power Dissipation	Pd max	1	W
Operating Temperature	Topr	−30 to +80	°C
Storage Temperature	Tstg	−55 to +150	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	unit
Input Voltage	V_{IN}		5.9 to 14	V
Output Current	I_{OUT}		0 to 250	mA
'H'-Level Reset Output Current	$I_{\overline{ORH}}$		0 to 200	μA
'L'-Level Reset Output Current	$I_{\overline{ORL}}$		0 to 2	mA
Auxiliary Regulator Output Current	I_{OA}		0 to 10	mA
Driver Output Voltage	V_{OD} max		14	V
'L'-Level Driver Output Current	I_{ODL} max		120	mA
'H'-Level Driver Input Voltage	V_{IDH}	I_{ODL} = 120mA	3 to 14	V
'L'-Level Driver Input Voltage	V_{IDL}	$I_{ODL} \leqq$ 100μA	−0.3 to +0.3	V

Operating Characteristics at Tj = 25°C, V_{IN} = 6V, I_{OUT} = 200mA, See specified Test Circuit.

Parameter	Symbol	Conditions	min	typ	max	unit
[Main regulator : Output ON-state, V_{EN} = 'H' or open]						
Output Voltage	V_O		5.0	5.2	5.4	V
Dropout Voltage	V_{DROP}	I_{OUT} = 250mA		0.25	0.5	V
Line Regulation	$\Delta V_{OLN}1$	$5.5V \leqq V_{IN} \leqq 14V$		30	80	mV
	$\Delta V_{OLN}2$	$6V \leqq V_{IN} \leqq 14V$		20	40	mV
Load Regulation	$\Delta V_{OLD}1$	$5mA \leqq I_{OUT} \leqq 250mA$		40	100	mV
	$\Delta V_{OLD}2$	$5mA \leqq I_{OUT} \leqq 100mA$		14	50	mV
Peak Output Current	I_{OP}		250	500		mA
Output Short Current	I_{OSC}			80	300	mA
Current Drain	I_Q1	I_{OUT} = 0		2.2	6	mA
	I_Q2			10	30	mA
Output Noise Voltage	V_{NO}	$10Hz \leqq f \leqq 100kHz$		70		μVrms
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta Tj$	Tj = 25 to 80°C		−0.7		mV/°C
Ripple Rejection	Rrej	f = 120Hz, $7V \leqq V_{IN} \leqq 13V$		74		dB
Output ON-State Control Voltage	V_{ENH}	Main regulator, driver ON	2.6		V_{IN}	V
[Main regulator : Output OFF-state, V_{EN} = 'L']						
'L'-Level Output Voltage	$V_{O\,OFF}$	V_{EN} = 0		50	200	mV
Quiescent Current	$I_{Q\,OFF}$	V_{EN} = 0		1.5	4	mA
Output OFF-State Control Voltage	V_{ENL}	Main regulator, driver OFF			1.0	V
[Reset circuit]						
'H'-Level Reset Output Voltage	$V_{\overline{ORH}}$	$I_{\overline{ORH}}$ = 200μA	4.97	5.17	5.37	V
'L'-Level Reset Output Voltage	$V_{\overline{ORL}}$	$I_{\overline{ORL}}$ = 2mA, V_{IN} = 3.7V		90	200	mV
Reset Threshold Voltage	V_{RT}	I_{OUT} = 5mA	3.7	3.9	4.1	V
Reset Hysteresis Voltage	V_{hys}	I_{OUT} = 5mA	50	150	300	mV
Reset Output Delay Time	t_d	C_d = 0.1μF	7.5	10	12.5	mS
[Auxiliary regulator]						
Output Voltage	V_{OA}	I_{OA} = 5mA	3.2	3.4	3.6	V
Line Regulation	$\Delta V_{OA\,LN}$	$6V \leqq V_{IN} \leqq 14V$, I_{OA} = 5mA		15	40	mV
Load Regulation	$\Delta V_{OA\,LD}$	$2mA \leqq I_{OA} \leqq 10mA$		130	200	mV
Output Short Current	I_{OASC}		10	30		mA
Output Pin Leakage Current	$I_{OA\,LEAK}$	V_{IN} = 0, V_{OA} = 6V			2	μA
[Darlington driver]						
'L'-Level Driver Output Voltage	$V_{ODL}1$	I_{ODL} = 80mA, V_{ID} = 3V		1.1	1.6	V
	$V_{ODL}2$	I_{ODL} = 120mA, V_{ID} = 3V		1.2	1.8	V
'H'-Level Driver Input Current	I_{IDH}	I_{ODL} = 120mA, V_{ID} = 3V		0.4	1	mA
Output Pin Leakage Current	I_{ODH}	V_{IH} = 14V, V_{OD} = 14V, V_{ID} = 0.3V			50	μA

Pin Assignment

GND Cd $\overline{RES}$ V_{OA} V_{ID}

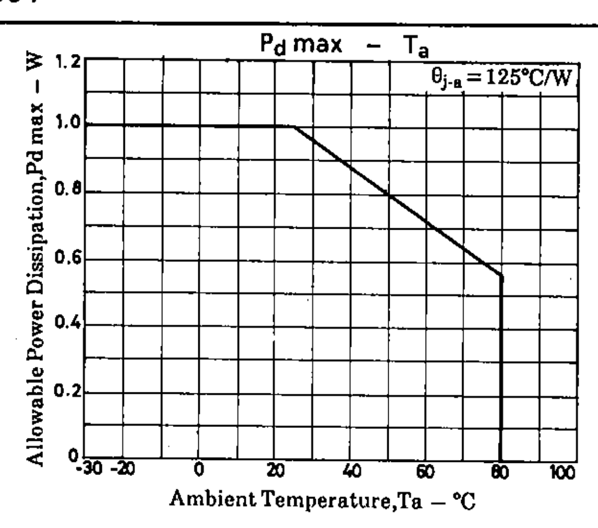
10 9 8 7 6

LA5601

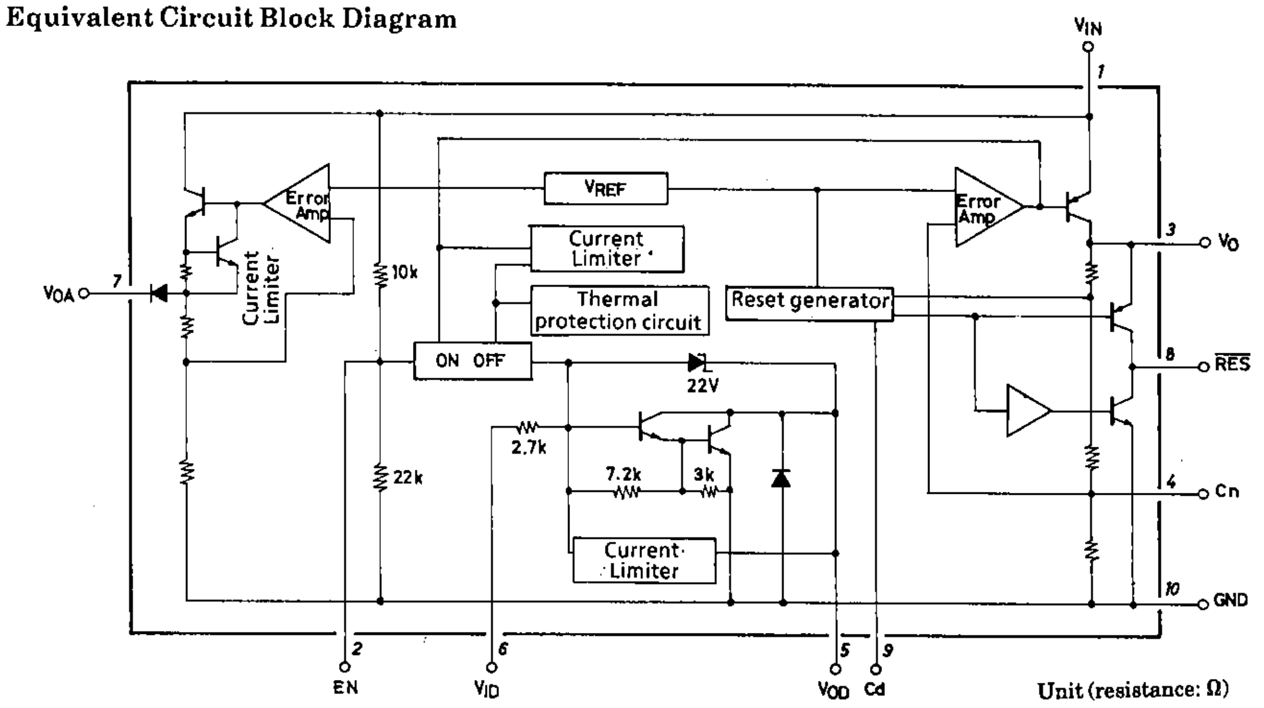
1 2 3 4 5

V_{IN} EN V_O Cn V_{OD}

Top view

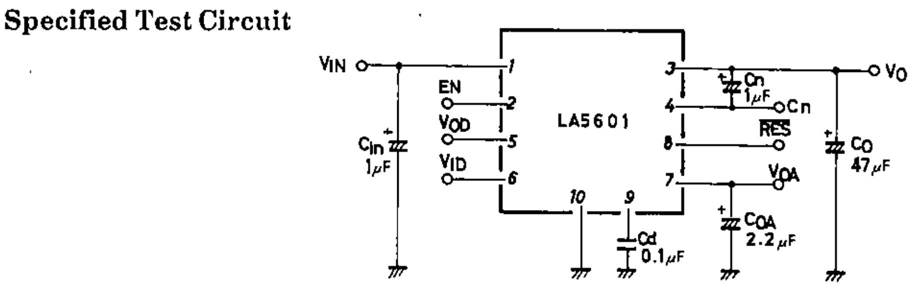


Equivalent Circuit Block Diagram

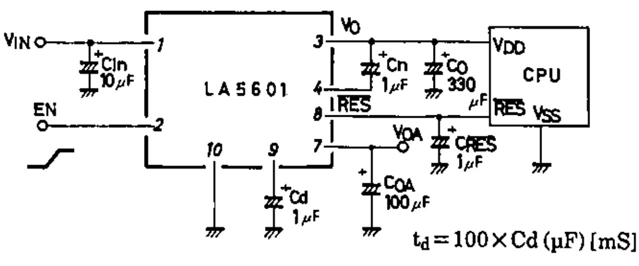


Unit (resistance: Ω)

Specified Test Circuit



Sample Application Circuit 1



$t_d = 100 \times Cd\ (\mu F)\ [mS]$

Note) 1. Capacitors C_n and $C_{\overline{RES}}$ are only required if problems are experienced with noise from external sources.

2. If capacitor C_n is present, ensure that C_o is at least more than one-third of the value of C_{in} in order to prevent output noise at power-down due to capacitor discharge timing.

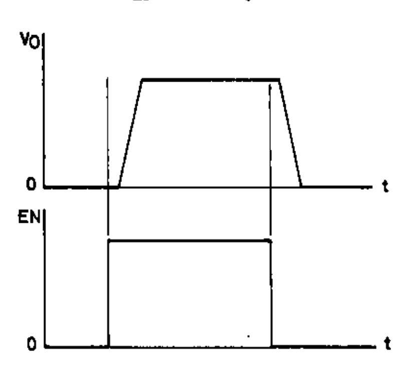
3. The minimum recommended value of output capacitor C_o is 47μF.

4. Use a low temperature coefficient capacitor for the delay time capacitor C_d.

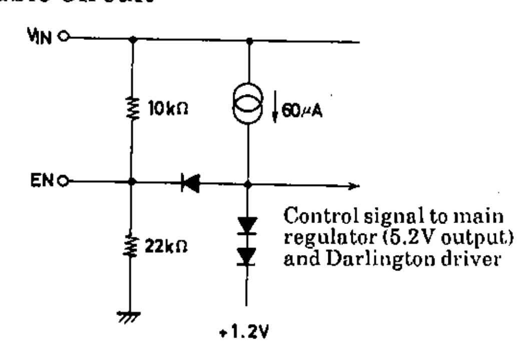
Function Table

V_{EN}	V_O	Driver
L	L	OFF
H	H	ON

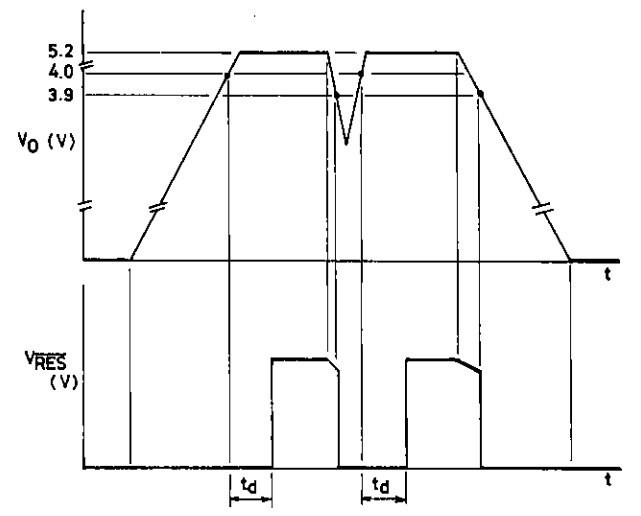
V_{EN} = 'H' or open.



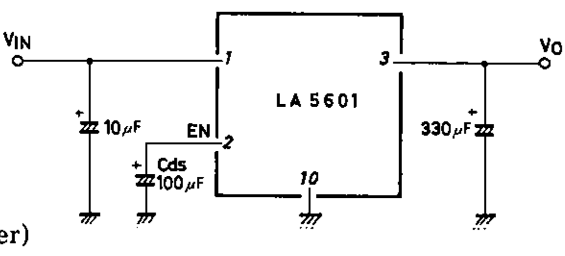
Enable Circuit



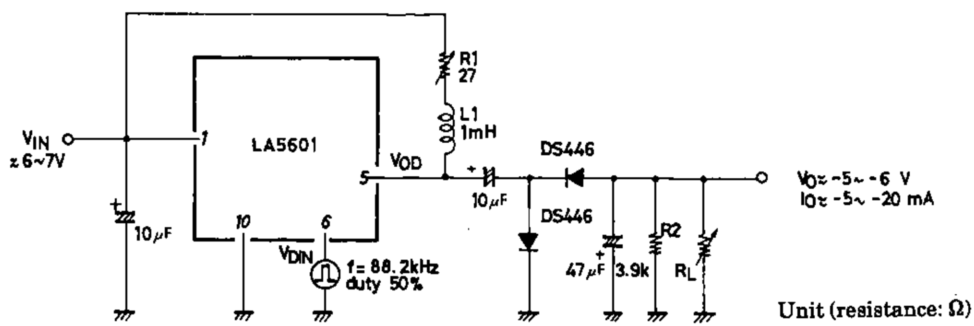
Reset Operation



Sample Application Circuit 2
(Delay start regulator)



Sample Application Circuit 3
(Positive-to-negative DC converter)

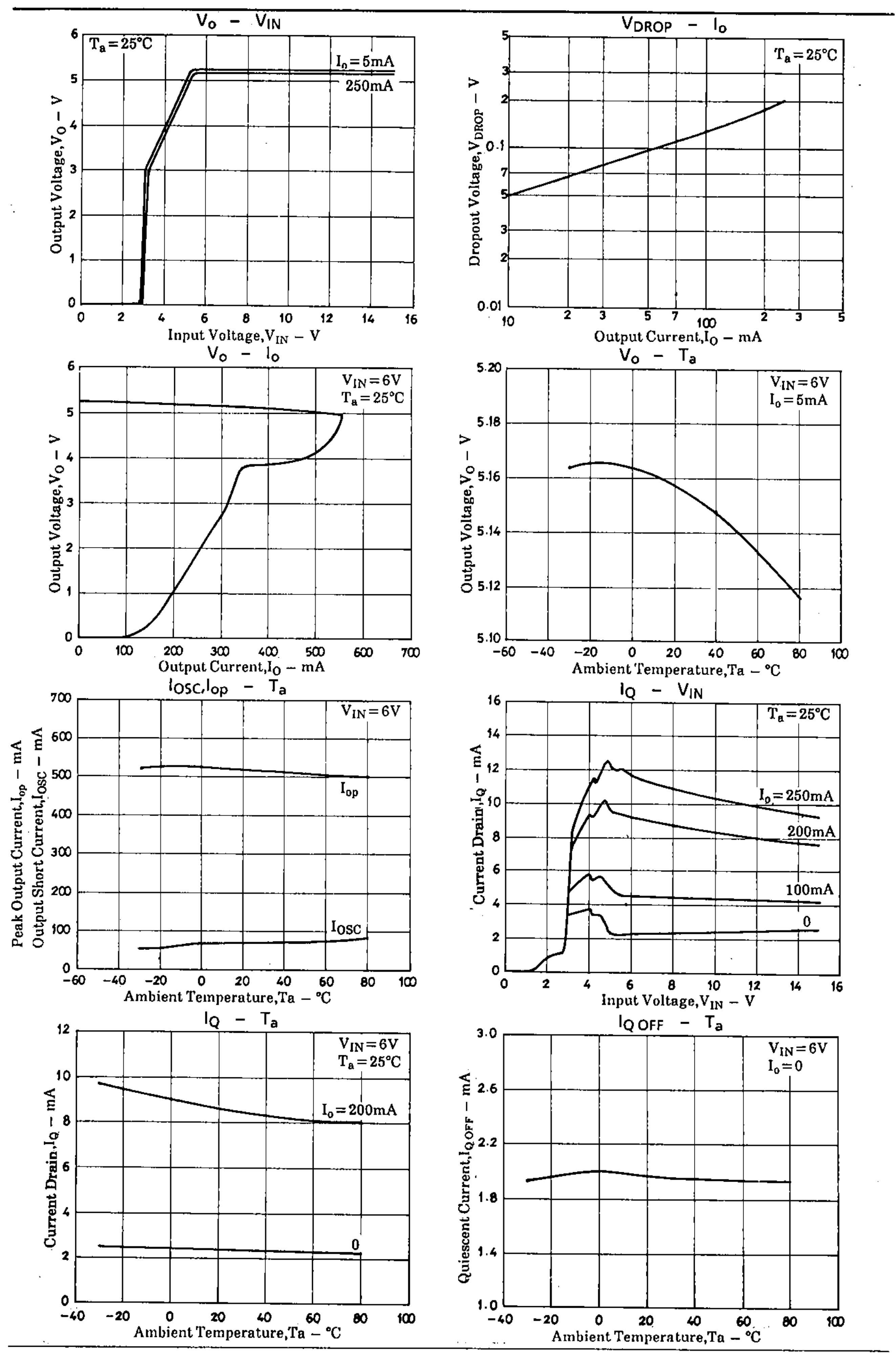


Unit (resistance: Ω)

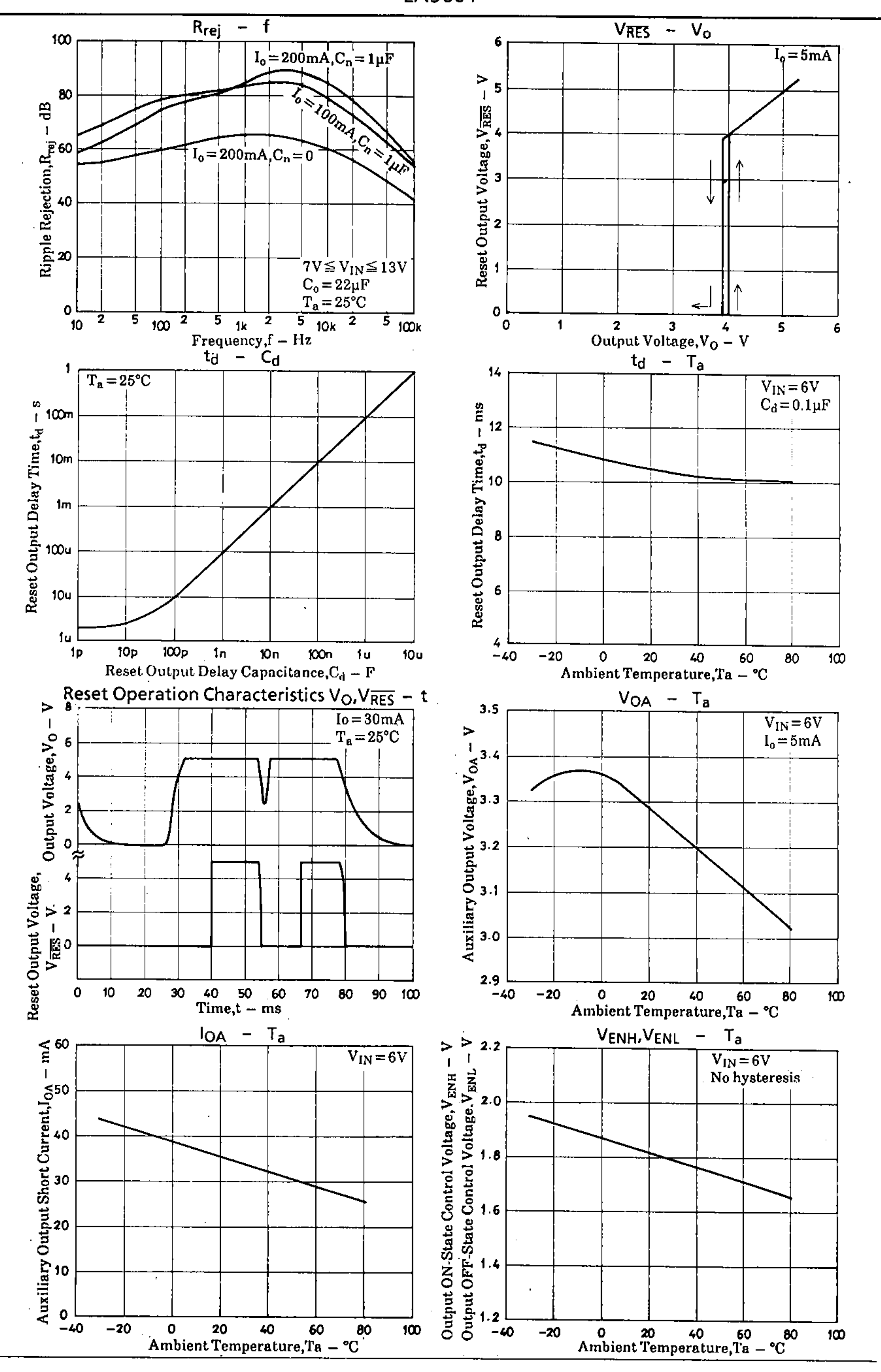
Note) 1. The output voltage can be fine-trimmed by adjusting R1. To protect the output transistor against over voltage, ensure that either R1 is non zero or use a low-Q coil for L1.

2. A load must always be present on power-up. To safeguard against excessive output voltages that occur when the circuit is powered up without a load, a dummy load resistor is recommended. This is shown on the circuit as R2.

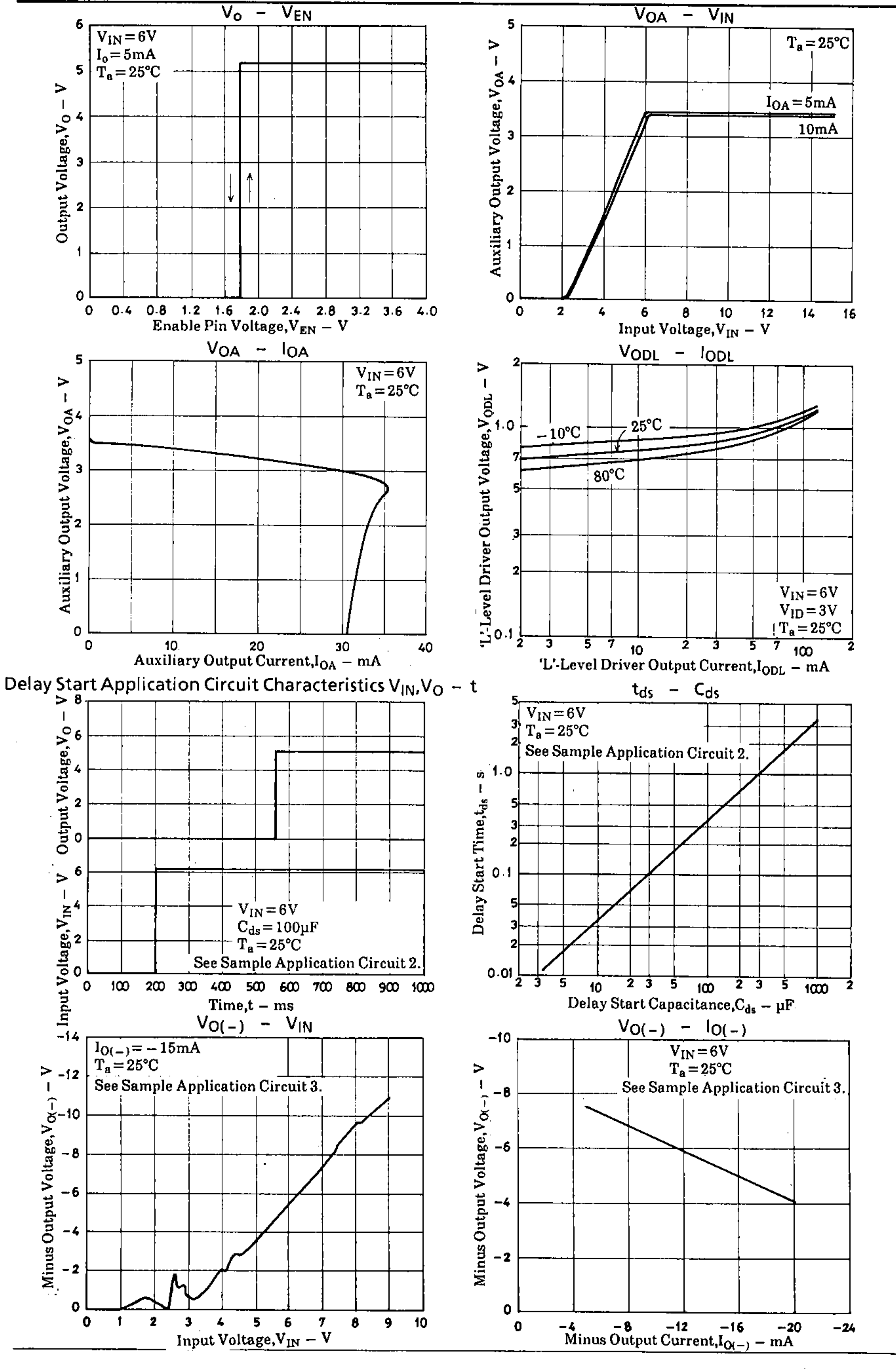
3. Select V_{IN}, R1 and L1 so that $V_{OD}<14V$, and $I_{ODL}<120mA$. The component values shown require that V_{IN} never exceeds 9V.



VO – VIN
Ta=25°C
IO=5mA
250mA
Output Voltage,VO – V
Input Voltage,VIN – V
VDROP – IO
Ta=25°C
Dropout Voltage,VDROP – V
Output Current,IO – mA
VO – IO
VIN=6V
Ta=25°C
Output Voltage,VO – V
Output Current,IO – mA
VO – Ta
VIN=6V
IO=5mA
Output Voltage,VO – V
Ambient Temperature,Ta – °C
IOSC,IOP – Ta
VIN=6V
IOP
IOSC
Peak Output Current,IOP – mA
Output Short Current,IOSC – mA
Ambient Temperature,Ta – °C
IQ – VIN
Ta=25°C
IO=250mA
200mA
100mA
0
Current Drain,IQ – mA
Input Voltage,VIN – V
IQ – Ta
VIN=6V
Ta=25°C
IO=200mA
0
Current Drain,IQ – mA
Ambient Temperature,Ta – °C
IQ OFF – Ta
VIN=6V
IO=0
Quiescent Current,IQ OFF – mA
Ambient Temperature,Ta – °C



R_{rej} – f
I_o=200mA,C_n=1μF
I_o=100mA,C_n=1μF
I_o=200mA,C_n=0
7V≦V_{IN}≦13V
C_o=22μF
T_a=25°C
Ripple Rejection,R_{rej} – dB
Frequency,f – Hz
$V_{\overline{RES}}$ – V_o
I_o=5mA
Reset Output Voltage,$V_{\overline{RES}}$ – V
Output Voltage,V_O – V
t_d – C_d
T_a=25°C
Reset Output Delay Time,t_d – s
Reset Output Delay Capacitance,C_d – F
t_d – T_a
V_{IN}=6V
C_d=0.1μF
Reset Output Delay Time,t_d – ms
Ambient Temperature,Ta – °C
Reset Operation Characteristics V_O,$V_{\overline{RES}}$ – t
Io=30mA
T_a=25°C
Output Voltage,V_O – V
Reset Output Voltage, $V_{\overline{RES}}$ – V.
Time,t – ms
V_{OA} – T_a
V_{IN}=6V
I_o=5mA
Auxiliary Output Voltage,V_{OA} – V
Ambient Temperature,Ta – °C
I_{OA} – T_a
V_{IN}=6V
Auxiliary Output Short Current,I_{OA} – mA
Ambient Temperature,Ta – °C
V_{ENH},V_{ENL} – T_a
V_{IN}=6V
No hysteresis
Output ON-State Control Voltage,V_{ENH} – V
Output OFF-State Control Voltage,V_{ENL} – V
Ambient Temperature,Ta – °C



Vo – VEN
VIN=6V
Io=5mA
Ta=25°C
Output Voltage,VO – V
Enable Pin Voltage,VEN – V
VOA – VIN
Ta=25°C
IOA=5mA
10mA
Auxiliary Output Voltage,VOA – V
Input Voltage,VIN – V
VOA – IOA
VIN=6V
Ta=25°C
Auxiliary Output Voltage,VOA – V
Auxiliary Output Current,IOA – mA
VODL – IODL
–10°C
25°C
80°C
VIN=6V
VID=3V
Ta=25°C
'L'-Level Driver Output Voltage,VODL – V
'L'-Level Driver Output Current,IODL – mA
Delay Start Application Circuit Characteristics VIN,VO – t
Output Voltage,VO – V
Input Voltage,VIN – V
VIN=6V
Cds=100µF
Ta=25°C
See Sample Application Circuit 2.
Time,t – ms
tds – Cds
VIN=6V
Ta=25°C
See Sample Application Circuit 2.
Delay Start Time,tds – s
Delay Start Capacitance,Cds – µF
VO(-) – VIN
IO(-)=–15mA
Ta=25°C
See Sample Application Circuit 3.
Minus Output Voltage,VO(-) – V
Input Voltage,VIN – V
VO(-) – IO(-)
VIN=6V
Ta=25°C
See Sample Application Circuit 3.
Minus Output Voltage,VO(-) – V
Minus Output Current,IO(-) – mA